Renewable Energy Question 7: *How does Michigan's renewables requirement compare to other states/provinces/countries? How are other jurisdictions similar/dissimilar? What has been the experience in other jurisdictions in terms of compliance, costs, reliability, and environmental impact?*

Executive Summary

1. Michigan set an early and aggressive target in PA 295 of 2008 to obtain 10% of retail electricity sales from renewable energy by 2015. The law also includes provisions to evaluate performance, costs, and other considerations related to this renewable portfolio standard (RPS) before setting goals beyond 2015. Many other states took a different approach with long-term standards that are higher than Michigan's early target.

2. There are numerous considerations when comparing RPS requirements among states. These include not only the timeline, numerical target (typically stated in terms of percentage of sales), and qualifying technologies, but also applicability to different types of providers (such as municipal or cooperative utilities or alternative energy suppliers), in-state restrictions, ownership requirements, treatment of existing renewable resources, renewable resource potential, and compliance or enforcement provisions. While not technically part of a state's RPS policy, other regulatory or market characteristics may also affect the development of renewable energy. Overall, Michigan's policies and market design are supportive of renewable energy.

3. Most states are on track to comply with their RPS requirements but since many states have targets that are years away, we have not yet fully experienced the operating and cost impacts. Some states have already experienced operating challenges.

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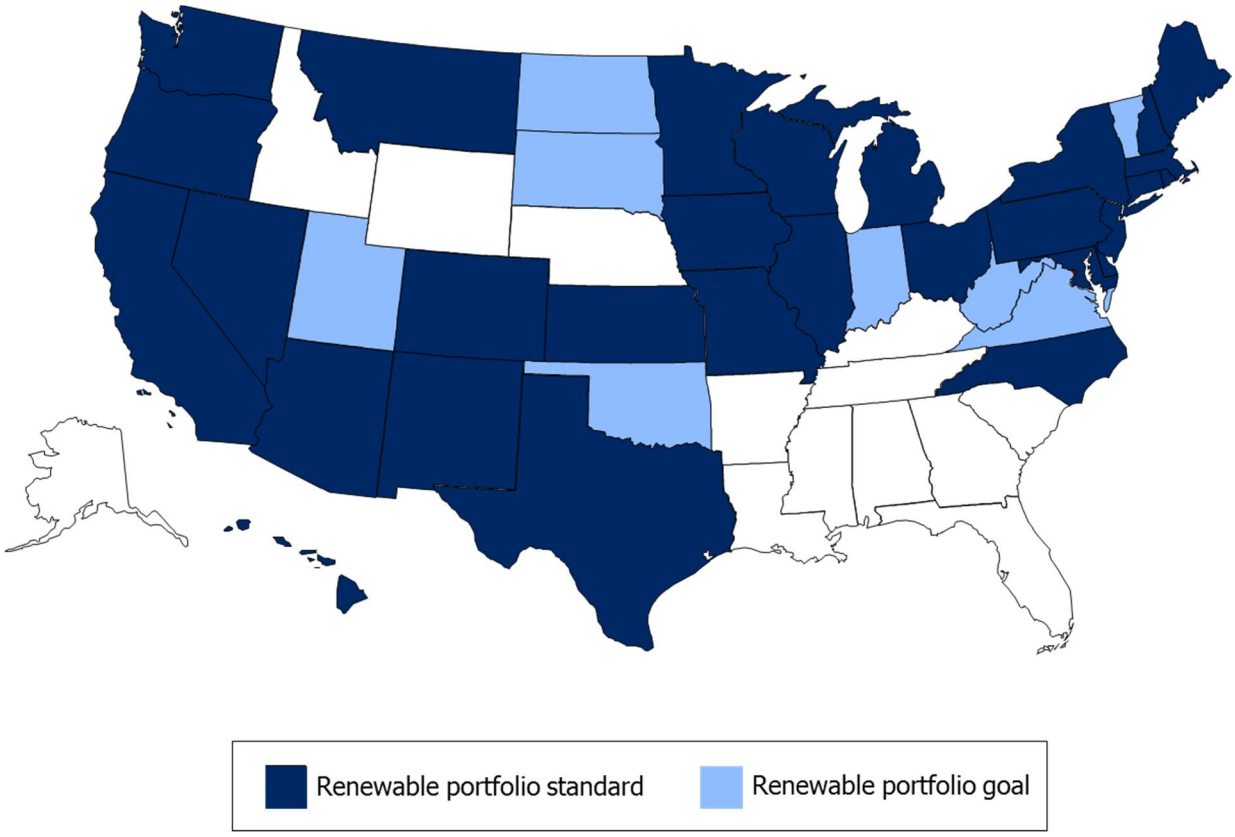
1. Michigan set an early and aggressive target in PA 295 of 2008 to obtain 10% of retail electricity sales from renewable energy by 2015. The law also includes provisions to evaluate performance, costs, and other considerations related to this renewable portfolio standard (RPS) before setting goals beyond 2015. Many other states took a different approach with long-term standards that are higher than Michigan's early target.

An RPS is a requirement on retail electric suppliers to supply a minimum percentage or amount of their retail load with eligible sources of renewable energy.[1] Twenty-nine states, the District of Columbia, and two U.S. territories have an RPS but no two jurisdictions are exactly the same. A summary of state RPS requirements is shown in Exhibit 1, with details in Appendix 1. An additional eight states have non-enforceable renewable goals, as shown in the map. Detailed and up-to-date information on RPS standards in all states is included in the Database of State Incentives for Renewables and Efficiency (DSIRE), maintained by the North Carolina Solar Center and funded by the U.S. Department of Energy.

[1] Ryan Wiser & Galen Barbose, Lawrence Berkeley National Laboratory, *The State of the States: Update on the Implementation of U.S. Renewables Portfolio Standards* (Presentation), 2011 National Summit on RPS, Washington D.C., October 26, 2011. Available at: http://www.cleanenergystates.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf (accessed 3/7/13).

Renewable Energy Question 7: *How does Michigan's renewables requirement compare to other states/provinces/countries? How are other jurisdictions similar/dissimilar? What has been the experience in other jurisdictions in terms of compliance, costs, reliability, and environmental impact?*

EXHIBIT 1. Renewable Portfolio Standards and Goals in U.S.

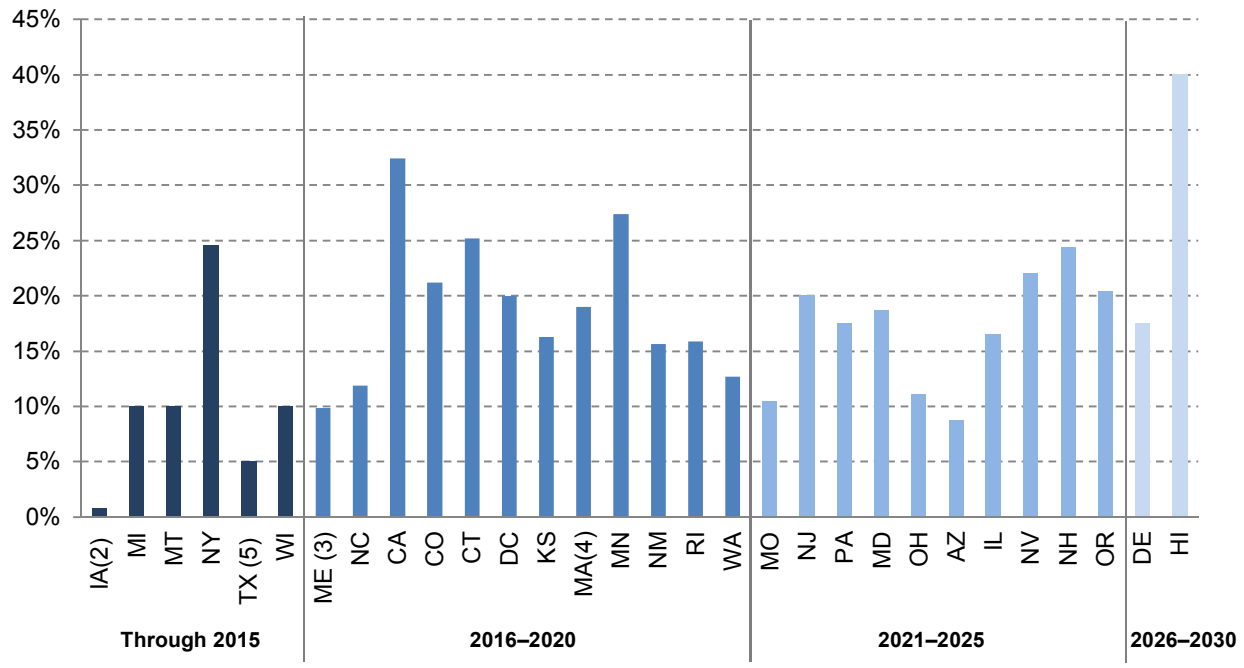


SOURCE: Database of State Incentives for Renewable Energy and Efficiency, DSIREusa.org , January 2013 update.

When comparing RPSs, it is important to consider the applicability to various types of providers, namely investor-owned utilities (IOUs), municipally owned utilities, electric cooperatives, and alternative energy suppliers (AESs). Certain types of entities may be exempt or there may be a threshold for a minimum number of customers for the standard to apply (in Illinois, for example, the threshold is IOUs with at least 100,000 customers). These exemptions are important when evaluating the stated percentage because an RPS does not necessarily cover the entire state's load. Exhibit 2 and Appendix 1 show the adjusted standard if the RPS were based on the state's total load. For example, the Illinois RPS of "25% by 2025" equates to 16.5% statewide because Illinois exempts municipal utilities and cooperatives and has a lower standard for AESs. Minnesota's standard is adjusted to reflect the higher standard applicable to one utility, Xcel. This adjustment was made for all states, as applicable, in Exhibit 2.

Renewable Energy Question 7: *How does Michigan's renewables requirement compare to other states/provinces/countries? How are other jurisdictions similar/dissimilar? What has been the experience in other jurisdictions in terms of compliance, costs, reliability, and environmental impact?*

EXHIBIT 2. State RPS - Adjusted for % Total Sales



SOURCE: Public Sector Consultants, using data Database of State Incentives for Renewable Energy and Efficiency, DSIREusa.org, January 2013 update (2013).

A few states, namely California, Colorado, Hawaii, Illinois, and Minnesota, have very aggressive long-term targets, even after factoring in existing renewable energy that counts toward the standard. The simple average of the RPS percentage targets, using the adjusted statewide percentages in Exhibit 2 and Appendix 1, is 17%. Many of the states have a higher percentage than Michigan's but the target applies in later years, typically in the 2020–2030 time frame. The ramp-up to meet the standard through 2015 is fairly similar to Michigan's (about 1% per year). Only five states have 2015 as the target date for compliance. Moreover, several states had large amounts of existing renewable resources (such as hydroelectric power in California, Maine, New York, Oregon, and Washington).

Michigan's RPS is equal or higher than all but one state with 2015 goals.

Key similarities and differences emerge when comparing Michigan to other Midwest states:

- Wisconsin has the same RPS (10% by 2015) as Michigan and both states apply the standard to all providers.
- Ohio is about on par with Michigan at 12.5% RPS (11% statewide) but Ohio's target does not have to be met until 2024. (Ohio's overall target is 25% but half of it can come from sources such as clean coal, nuclear, retrofitted existing coal, and other non-traditional sources, with the remaining half from traditional renewable sources.)

Renewable Energy Question 7: *How does Michigan's renewables requirement compare to other states/provinces/countries? How are other jurisdictions similar/dissimilar? What has been the experience in other jurisdictions in terms of compliance, costs, reliability, and environmental impact?*

- Minnesota has the most aggressive RPS in the Midwest (and among the highest in the nation) at 25% by 2025 (30% by 2020 for major utility Xcel), and it applies to all providers in the state.
- Illinois's RPS is also higher than Michigan's at 25% by 2025 but the adjusted percentage is 16.5% because of the lower standard applicable to alternative energy suppliers and the exemption of certain types of utilities.
- Iowa is unique with a very low RPS of 105 MWs (~1% on percentage basis) but actual renewable generation far exceeding the standard (over 4,500 MW, or roughly 30% of sales); this is likely due in part to non-mandatory goals, state financial incentives similar to the federal tax credit, available land, and a significant wind energy resource potential.
- Indiana has a non-enforceable renewable energy goal, which is set at 10% by 2025 (it is not included in Exhibit 2 because it is a goal).

See Appendix 2 for additional comparison of Michigan's RPS with other Midwest states. Under PA 295 of 2008, Michigan took a measured approach to ramp up to the 10% standard by 2015, and evaluate performance and costs along the way. The statute's interim targets, beginning in 2012, are as follows:

- 2012: 4.8%
- 2013: 5.6%
- 2014: 6.75%
- 2015: 10%

This approach has allowed utilities to gradually and steadily plan, procure, construct, and interconnect renewable energy within the state. There is considerable development activity in many parts of the state, and providers are on target to meet the RPS, with a few exceptions.[2] The law also requires the MPSC to submit an annual report to the legislature on the implementation of the standard and its cost-effectiveness. The report must include any recommendations the MPSC may have to amend the law, such as changes to the definition of renewable energy resource.

2. There are numerous considerations when comparing RPS requirements among states. Overall, Michigan's policies and market design are supportive of renewable energy.

As discussed above, there are many facets to the design and implementation of RPSs, and these elements can be important when comparing RPSs among jurisdictions. These include, but are not limited to the following:

- Numerical target (typically stated in terms of percentage of sales but can also include MW capacity requirements, as discussed under Renewable Energy Question 12)
- Applicability to different types of providers and the percentage of sales to which the standard applies (see above)
- Timeline for RPS compliance (including interim targets) (see above)

[2] According to the MPSC's February 2013 report, only one provider (Detroit Public Lighting Department) is not on pace to meet interim targets as well as the overall 10% target. DPL is expected to be unable to meet the standard because of surcharge caps under the law. There are mechanisms in the law for handling noncompliance and extensions.

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- Qualifying technologies, including treatment of existing renewable resources (see Renewable Energy Question 23)
- In-state generation requirements or ownership restrictions (see Renewable Energy Questions 13 and 18)
- Renewable resource potential (see Renewable Energy Question 8)
- Compliance and enforcement provisions (see Renewable Energy Question 21)

While not technically part of a state's RPS policy, other regulatory or market characteristics may also affect the development of renewable energy, such as cost allocation for transmission upgrades, planning and siting requirements, and the existence of wholesale markets and treatment of intermittent resources under wholesale market rules. Overall, Michigan's policies and market design are supportive of renewable energy.

3. Most states are on track to comply with their RPS requirements but since many states have targets that are years away, we have not yet fully experienced the operating and cost impacts. Some states have already experienced operating challenges.

Researchers at Lawrence Berkeley National Laboratory (LBNL) track costs, impacts, and other trends related to RPS and renewable energy. They noted that the enactment of new RPS policies is waning, but states continue to hone existing policies.[3] The timeline in Appendix 3 illustrates this trend. Recently, policymakers in a few states (Kansas, Missouri, and Ohio) have opened up their RPS for review.

Key findings related to compliance, costs, reliability, and environmental impacts in other jurisdictions are summarized below. Overall, there have not been any major problems in these areas. RPSs appear to be driving renewable energy development trends; in 2011, renewable energy accounted for about a third of all new capacity additions in the United States.[4] According to researchers at the National Renewable Energy Laboratory, new generation required by RPS policies is estimated to be more than 150 million MWh, or more than 40,000 MW, by 2015.[5] The largest state markets in 2020 for *new* renewables include California, Illinois, Texas, Minnesota, and New Jersey, as shown in Exhibit 3. If full compliance with RPS standards is achieved, it will represent a total of 100 gigawatts of new renewable capacity by 2035 (or 7 percent of projected generation in 2035).[6]

[3] Ryan Wiser & Galen Barbose, Lawrence Berkeley National Laboratory, *The State of the States: Update on the Implementation of U.S. Renewables Portfolio Standards* (Presentation), 2011 National Summit on RPS, Washington D.C., October 26, 2011. Available at: http://www.cleanenergystates.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf.
[4] U.S. DOE, 2011 Renewable Energy Data Book (Revised), Available at: http://www.nrel.gov/docs/fy13osti/54909.pdf. See also Ryan Wiser & Galen Barbose presentation, referenced above.
[5] Jenny Heeter and Lori Bird, National Renewable Energy Laboratory, *Status and Trends in U.S. Compliance and Voluntary Renewable Energy Certificate Markets*, Technical Report, October 2011, Available at: http://apps3.eere.energy.gov/greenpower/pdfs/52925.pdf.
[6] Wiser and Barbose presentation, cited above.

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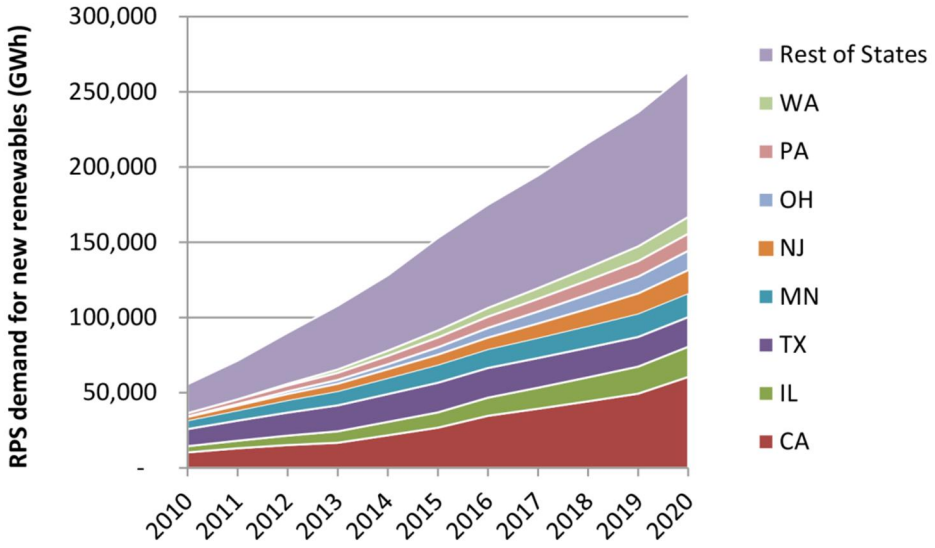
EXHIBIT 3. Historic and Projected Estimated Demand
for New Renewable Energy Due to State RPS Requirements, 2010–2020



SOURCE: Jenny Heeter and Lori Bird, National Renewable Energy Laboratory, *Status and Trends in U.S. Compliance and Voluntary Renewable Energy Certificate Markets*, Technical Report, October 2011, Available at: http://apps3.eere.energy.gov/greenpower/pdfs/52925.pdf.

Compliance—The operational experience with state RPS compliance remains somewhat limited, as shown below. In general, non-compliance with RPS requirements in other states has not been an issue although the majority of states have less than four years of experience. The LBNL tracks compliance with tracking spreadsheets available as part of the DSIRE database.[7] Exhibit 4 shows the RPS achievement from 2009 through 2011, with the majority of states at 100%. Over the past couple of years, New York and Massachusetts appear to be behind targets. Note that the percentages represent the renewable generation (or renewable energy credits) compared to the RPS obligations in that year across all applicable providers. As noted by the LBNL, this does not represent compliance, per se, as each state handles it differently (e.g., alternative compliance payments and deferred obligations are not counted toward the percentage).

[7] See LBNL, RPS Compliance Summary Data, Last Updated August 26, 2012. Available at: DSIREusa.org.

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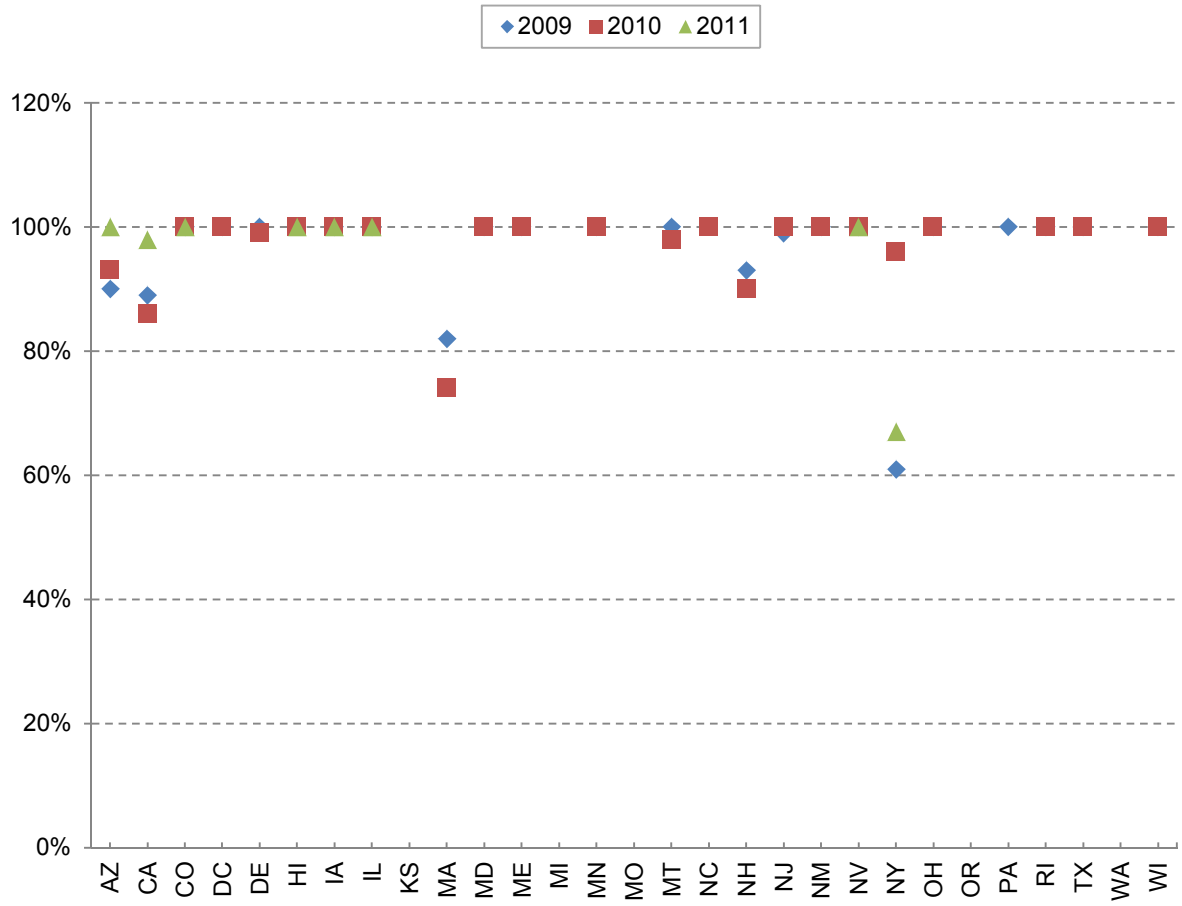
EXHIBIT 4. State RPS Achievement (Renewable Generation as Percentage of Annual RPS Obligation by State), 2009-2011



SOURCE: http://www.cleanenergystates.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf

Costs—According to national studies by the LBNL, rate impacts from the incremental cost of RPSs have been estimated at around 5%. But it is important to understand which costs are and are not attributed to the RPS. See Renewable Energy Question 32 for additional details on compliance costs and rate impacts.

Reliability/Integration challenges—Increased amounts of intermittent resources, particularly wind energy, can create challenges for utilities and grid operators from both a planning and operations standpoint. These challenges have occurred in Texas, the Midwest, and the Pacific Northwest. Findings from a Massachusetts Institute of Technology (MIT) symposium concluded that:

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> As renewable capacity has increased, the intermittent nature of wind and solar generation, that is, both variable and unpredictable, has led to operational difficulties and unintended consequences for emissions and economic efficiency.[8]

In the Midwest, wind energy is generally conversely correlated to electricity usage. So wind output is lowest when electricity consumption is highest and vice versa. Therefore, balancing the electric system becomes more complex as more wind energy enters the system. Moreover, unanticipated events, such as outages of other power plants or transmission lines, coupled with dramatic changes in wind energy output, can also create reliability challenges.

In the Midwest, wind energy is generally conversely correlated to electricity usage. So wind output is lowest when electricity consumption is highest and vice versa.

These challenges are generally being handled through sophisticated modeling, transmission upgrades, wind forecasting enhancements, and changes to grid operational practices. As part of this effort, regional and national studies have been conducted by MISO as well as the U.S. DOE/National Renewable Energy Laboratory to examine the potential impacts and high-voltage transmission needs associated with increased wind energy.[9] While the studies have suggested that 20–30% wind energy by the 2024–2030 timeframe in the United States is operationally feasible **assuming substantial new investment in transmission facilities and other operational changes**, these studies did not examine the local reliability impacts of concentrating generation resources in particular areas. Reliability impacts and solutions can be very localized in nature, as shown in studies on proposed renewable energy developments in Michigan. Thus, issues in the Thumb area are different from those in southern Michigan or the Upper Peninsula. Moreover, the mix of generation over the next 5–7 years is expected to be dynamic, particularly in the Midwest with coal plant retirements and replacements, so it is important to consider these reliability issues holistically and over the long term.

Environmental impact—In general, renewable energy, particularly from wind or solar, is expected to benefit the environment compared to fossil fuel and nuclear generation. This can be in the form of reduced fuel use and related mining impacts, lower air emissions, and reduced water use and water discharges.[10]

According to the U.S. EPA, there are limited studies that have actually quantified the public health benefits of clean energy initiatives, and they tend to be location-specific. Moreover, the EPA notes that

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[8] Massachusetts Institute of Technology, *The MIT Energy Initiative's Symposium on Managing Large-Scale Penetration of Intermittent Renewables, Findings in Brief* (Boston: MIT, April 20, 2011). Available online: http://web.mit.edu/mitei/research/reports/intermittent-renewables-findings.pdf. (Accessed 8-15-12.)

[9] See, e.g., several studies: National Renewable Energy Laboratory, prepared by EnerNex Corporation, Eastern Wind Integration and Transmission Study (Knoxville, Tenn., January 2010, revised February 2011). Available online: http://www.nrel.gov/wind/systemsintegration/pdfs/2010/ewits_final_report.pdf . (Accessed 8-15-12.)
U.S. DOE, Office of Energy Efficiency and Renewable Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electric Supply*, DOE/GO-102008-2567 (Washington, D.C.: EERE, July 2008). Available online: http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf. (Accessed 8-15-12.)
Midwest ISO, *Regional Generation Outlet Study* (November 19, 2010). Available online: https://www.midwestiso.org/Library/Repository/Study/RGOS/Regional%20Generation%20Outlet%20Study.pdf. (Accessed 8-15-12.)

[10] U.S. DOE, Office of Energy Efficiency and Renewable Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electric Supply*, DOE/GO-102008-2567 (Washington, D.C.: EERE, July 2008). Available online: http://www1.eere.energy.gov/windandhydro/pdfs/41869.pdf. (Accessed 8-15-12.); Serchuck (2000).

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"methods to translate emissions reductions into changes in air quality and associated health benefits can be complicated."[11] The EPA's EGrid database has utility, state, and regional average emission factors for certain pollutants that can be used as a proxy for emission reductions, *assuming for the sake of simplicity* that renewable energy actually displaces other generation one for one and there are no emissions associated with the renewable generation. For example, for Michigan's Lower Peninsula, the average annual output emission rates[12] are:

- CO2—1,563 lbs/megawatt- hour
- Methane—33.93 lb/gigawatt-hour
- Nitrous Oxide—27.17 lb/gigawatt-hour

Guidance on translating these rates to estimate environmental impact of clean energy policies are presented in the EPA's guidebook for states.

Actual environmental impacts are very specific to the design and implementation of the state's RPS and the operations of the electric grid; that is, the environmental impacts are a function of the renewable (and sometimes qualifying non-renewable) resources that are actually used to generate power and whether and how that affects the overall mix of generation used to produce electricity. Some of the challenges are highlighted below:

- An RPS may be very high but do little to alter the mix of generation sources because the state is already producing large amounts of renewable energy (e.g., Maine's experience was a good example given the state had large amounts of existing hydro-electric and biomass).
- There are technologies that qualify under the RPS, such as municipal solid waste incineration or biomass, that may have higher emissions than new non-renewable resources such as natural gas, nuclear, or coal with advanced environmental controls.
- It is challenging to identify and quantify the generation that is displaced by renewable generation, particularly with regional energy markets. There is also the potential for renewable generation to affect the operations and emissions of conventional fossil fueled units (that is, increase emissions due to increased "ramping" up and down of fossil units to handle fluctuations in the intermittent output of wind energy).[13]

[11] U.S. EPA, *Assessing the Multiple Benefits of Clean Energy: A Resource for States* (February 2010). Available at: http://www.epa.gov/statelocalclimate/resources/benefits.html.
[12] See http://cfpub.epa.gov/egridweb/ghg.cfm.
[13] See Greg Brinkman, Debra Lew, Paul Denholm, National Renewable Energy Laboratory, *Impacts of Renewable Generation on Fossil Fuel Unit Cycling: Costs and Emissions*, Preliminary Background Paper, May 20, 2012. Available at: www.nrel.gov/docs/fy12osti/55828.pdf. Accessed 4-22-2013.

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Appendix 1:
State RPS Requirements

	Standard	Date	% Load	Adjusted Standard - State Equivalent
Arizona	15%	2025	58.5%	8.8%
California	33%	2020	98.2%	32.4%
Colorado		2020		21.2%
IOUs	*30%*	*2020*	*58.7%*	*17.6%*
Co-ops and large munis	*10%*	*2020*	*35.6%*	*3.6%*
Connecticut	27%	2020	93.4%	25.2%
Delaware	25%	2026	70.0%	17.5%
District of Columbia	20%	2020	100.0%	20.0%
Hawaii	40%	2030	100.0%	40.0%
Illinois		2025		16.5%
IOUs	*25%*	*2025*	*43.2%*	*10.8%*
AES [1]	*12.5%*	*2025*	*45.7%*	*5.7%*
Iowa[2]	1%	2000	75.7%	0.8%
Kansas	20%	2020	81.5%	16.3%
Maine[3]	10%	2017	98.3%	9.8%
Maryland	20%	2022	93.4%	18.7%
Massachusetts[4]	22.1%	2020	86.0%	19.0%
Michigan	10%	2015	100.0%	10.0%
Minnesota		2020/2025		27.4%
Xcel	*30%*	*2020*	*47.8%*	*14.3%*
Other	*25%*	*2025*	*52.2%*	*13.1%*
Missouri	15%	2021	70.0%	10.5%
Montana	15%	2015	66.6%	10.0%
Nevada	25%	2025	88.2%	22.1%
New Hampshire	24.8%	2025	98.2%	24.4%
New Jersey	20.4%	2021	98.3%	20.0%
New Mexico		2020		15.6%
IOUs	*20%*	*2020*	*67.7%*	*13.5%*
Co-ops	*10%*	*2020*	*20.8%*	*2.1%*
New York	29%	2015	84.7%	24.6%
North Carolina		2018/2021		11.9%
IOUs	*12.5%*	*2021*	*75.2%*	*9.4%*
Co-ops and munis	*10%*	*2018*	*24.8%*	*2.5%*
Ohio	12.5%	2024	88.6%	11.1%

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	Standard	Date	% Load	Adjusted Standard - State Equivalent
Oregon		2025		20.4%
Large utilities	*25%*	*2025*	*74.6%*	*18.7%*
Small utilities	*10%*	*2025*	*10.2%*	*1.0%*
Small utilities (<1.5% state's load)	*5%*	*2025*	*15.2%*	*0.8%*
Pennsylvania	18%	2021	97.3%	17.5%
Rhode Island	16%	2020	99.3%	15.9%
Texas[5]	5%	2015	n/a	5.0%
Washington	15%	2020	84.7%	12.7%
Wisconsin	10%	2015	100.0%	10.0%

SOURCE: Public Sector Consultants, 2013, based on data from Database of State Incentives for Renewables and Efficiency, January 2013.
NOTES:
[1] AESs are only required to meet 50% of standard but can elect to do 100%.
[2] Electricity sales in Iowa are 45,445,269 MWh; 105 MW in high-quality wind area (40% capacity factor) would be expected to produce 367,960 MWh per year, equivalent to 1% renewable energy. Iowa has over 4,000 MW of installed capacity, far exceeding the 105 MW minimum.
[3]This applies only to new renewable energy projects. Maine had standard of 30% by 2020, which included existing renewable resources. Maine had large percentage of existing hydro-electric that qualified.
[4] Massachusetts has goal of 15% by 2020 for new renewable resources, and this increases 1% annually thereafter.
[5] Texas' requirement of 5,880 MW by 2015 equates to approximately 5% of the state's electric load. Texas has already surpassed this goal with over 10,000 MW installed.

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Appendix 2:
Comparison of Midwest States

	MI	OH	IL	IA	MN	WI
Standard	10% by 2015	12.5% by 2024 (also 12.5% "alternative energy resources" by 2025 for total of 25%)	25% by 2025	105 MW***	25% by 2025 (30% by 2020 for Xcel)	10% by 2015
Applicability by Utility Type	All	Municipal and cooperatives exempt	Municipal and cooperatives exempt	Municipal and cooperatives exempt	All	All
Eligible technologies						
Biomass	X	X	X*	X	X*	X
Solar PV	X	X	X	X	X	X
Solar Thermal	X	X	X	X	X	X
Solid waste	Limited	X		X	X	X
Geothermal	X	X				X
Hydro	Limited	X	X	X	X	X
Landfill gas	X	X	X	X	X	X
Nuclear		X				
Clean coal		X				
Energy storage		X				
Combined heat and power		X				
Other waste heat recovery		X				
Fuel cells		X				X
Microturbines		X				

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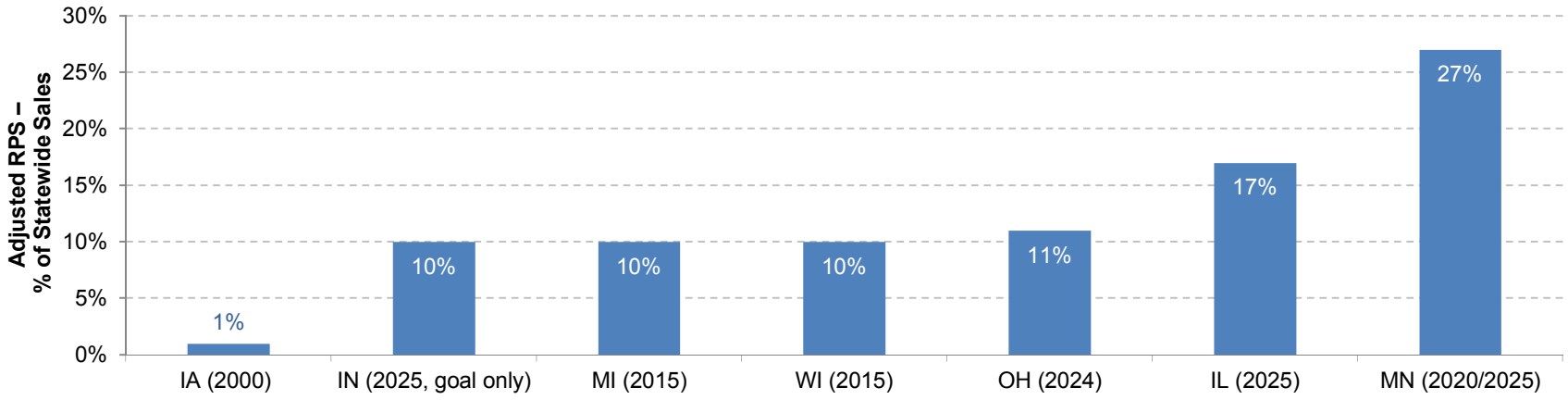
	MI	OH	IL	IA	MN	WI
Wind	X	X	X	X	X	X
Energy efficiency, demand response	X (capped)	X				
Retrofitted/refueled generation		X				
Co-firing					X	
In-state restriction	Yes	Yes, but limited to half of renewables	No**	Unknown	No	Generation can be outside WI but must serve WI customers
Off ramps	Yes	Yes, if costs >3% or force majeure	Yes, must be cost-effective	Not clear	Yes, if in public interest	

* Includes anaerobic digestion and biodiesel
** Previously there was a in-state requirement for investor-owned utilities with an exception if in-state generation was not cost-effective.
*** Governor later set a voluntary target of 1,000 MW.



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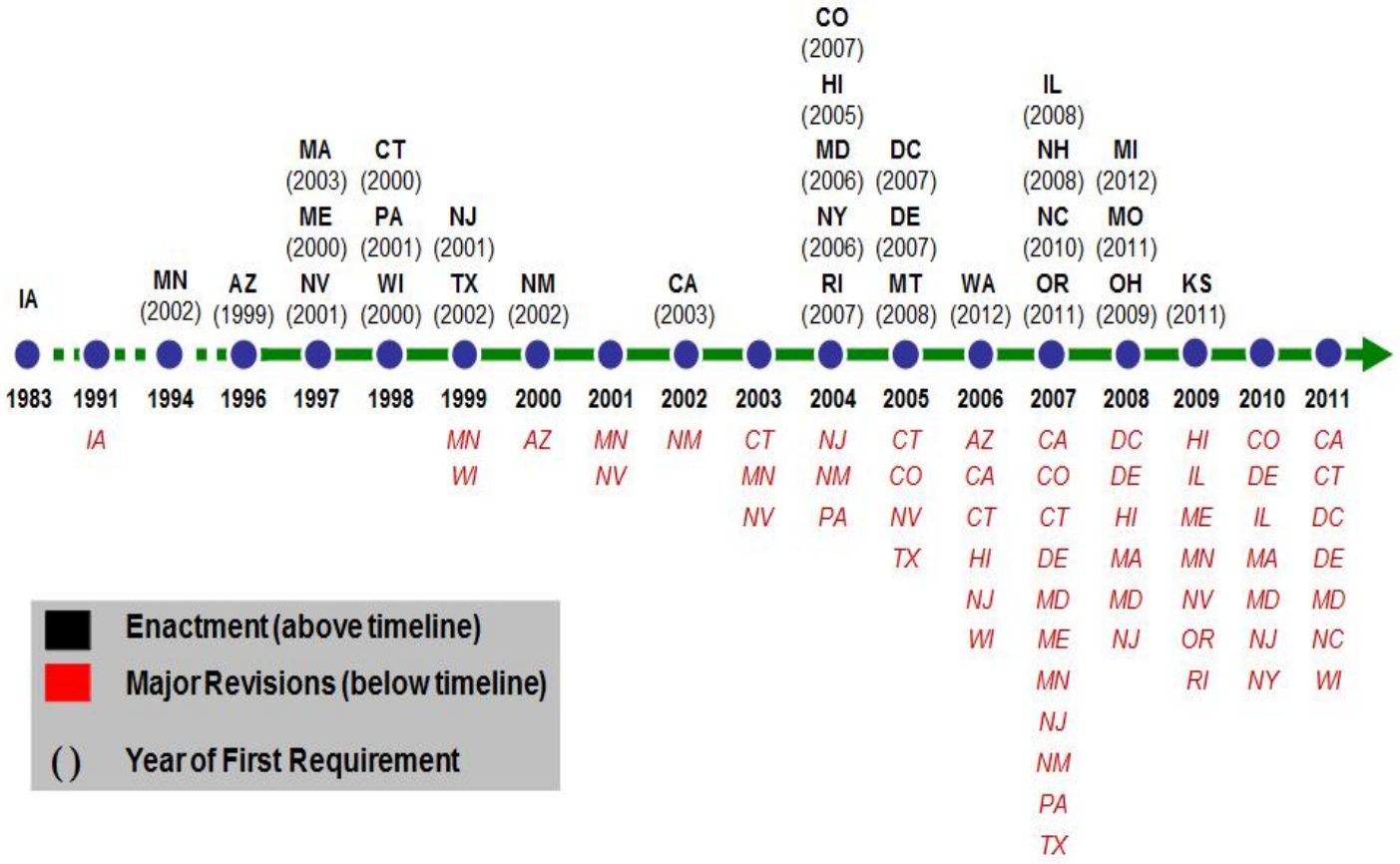
Appendix 3:
RPS Enactment and Revision Timeline



SOURCE: http://www.cleanenergystates.org/assets/Uploads/2011-RPS-Summit-Combined-Presentations-File.pdf